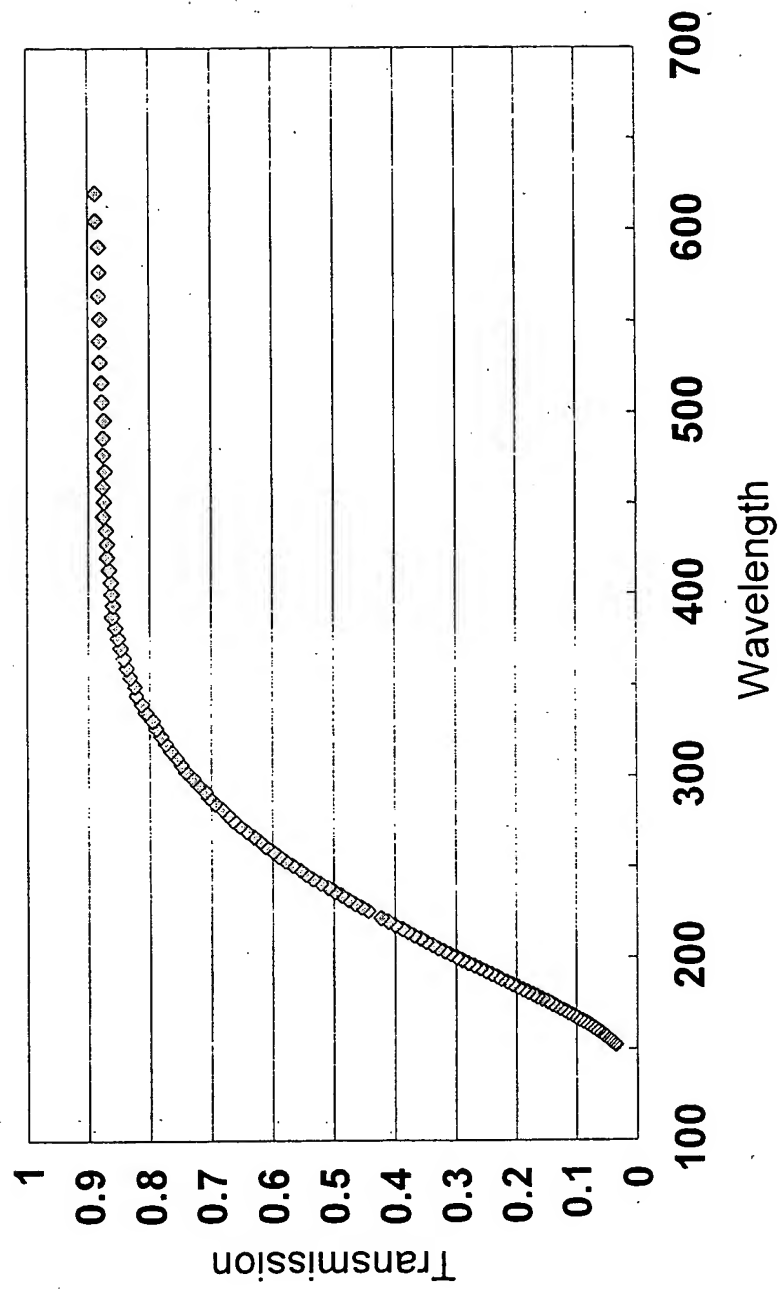
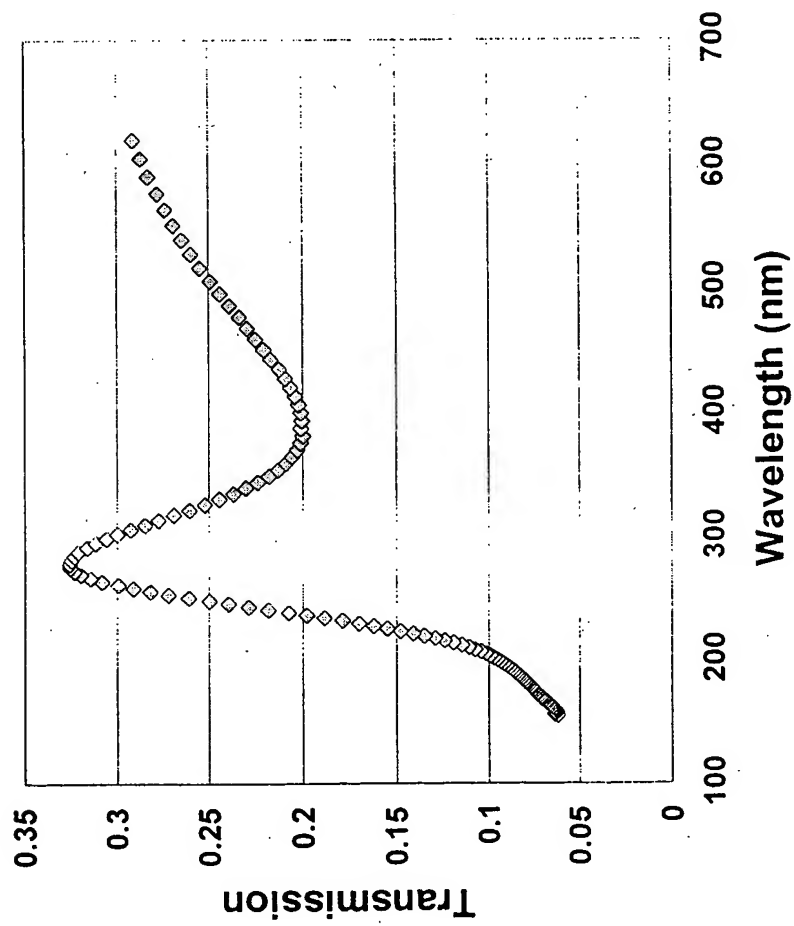
**Fig. 1**

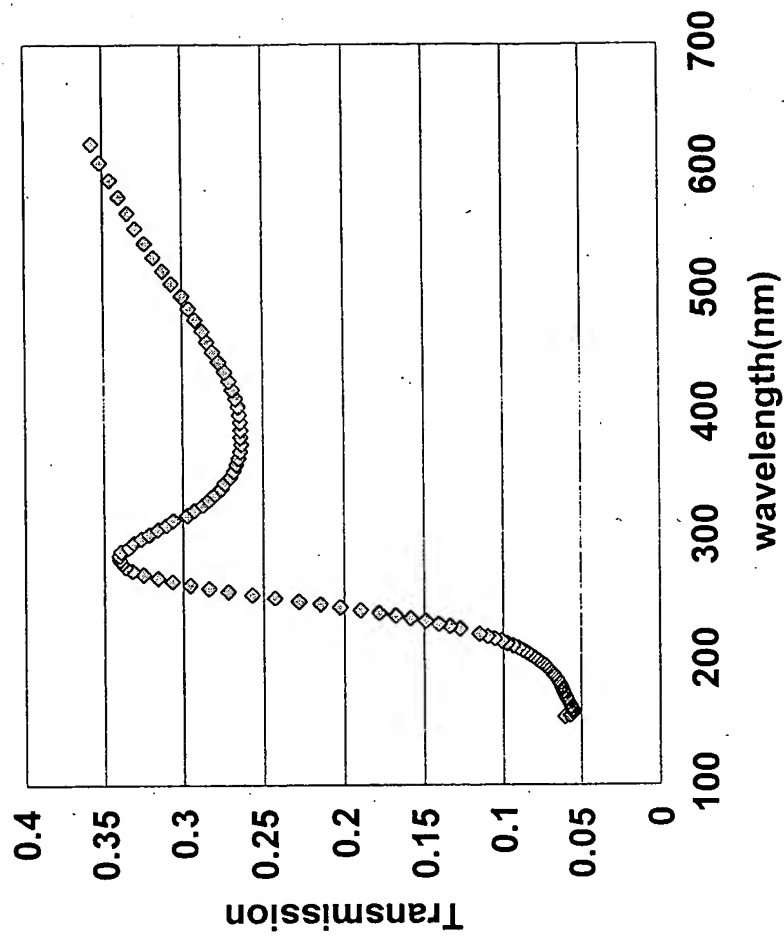
**SiTiON****Fig. 2**

ID	Si	Ti	O	N	n	k	thickness	T%
#1	29.9	4.3	66.9	0	1.67	0.175	1175 A	18.2
#2	33.5	3.0	43.7	19.2	2.04	0.307	765 A	13.6
#3	34.2	4.0	36.1	24.4	2.10	0.467	725 A	5.9
#4	35.2	4.5	32.7	27.3	2.08	0.530	740 A	3.8
#5	39.1	4.3	16.3	40.3	2.08	0.591	743 A	2.6
#6	41.6	3.3	1	54.1	2.39	1.025	590 A	0.0

Fig. 3



(a)



(b)

Fig. 4

	thickness	n	k	T%
SiTiO (phase shifter layer)	1150 Å	1.673	0.175	5.9
Ti (etch stop layer)	149 Å	1.121	1.230	
SiTiO (phase shifter layer)	1170 Å	1.673	0.175	5.9
Ta (etch stop layer)	106 Å	1.251	1.667	

Fig. 5

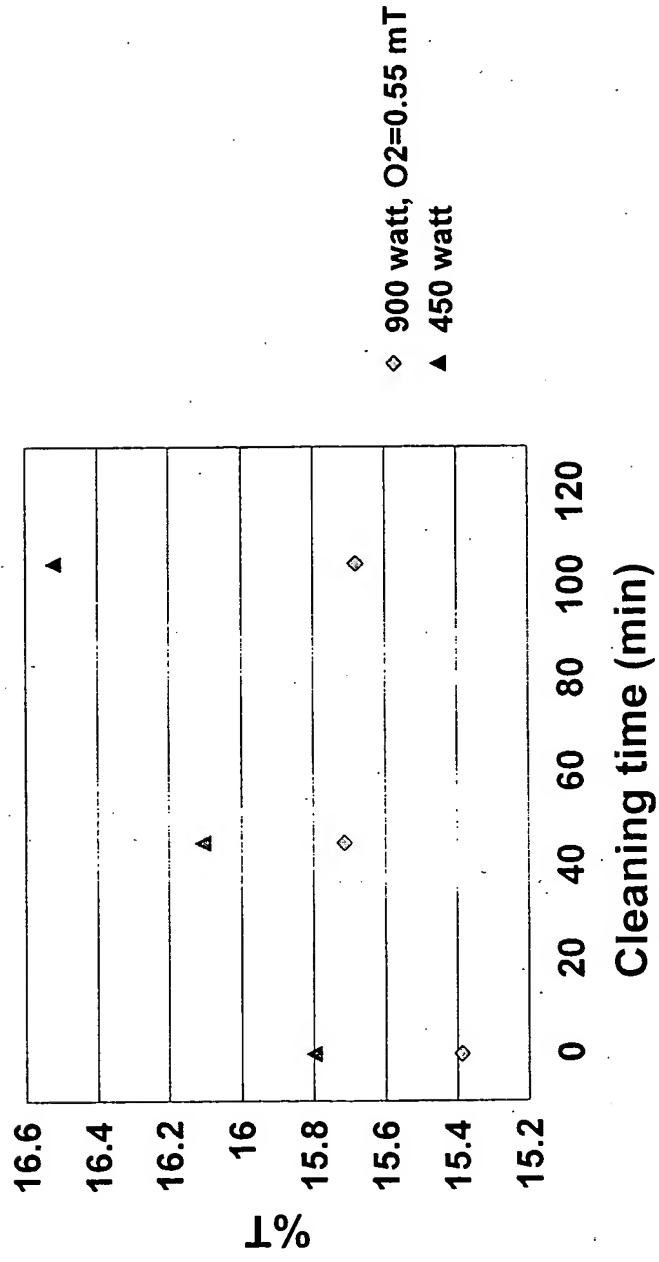
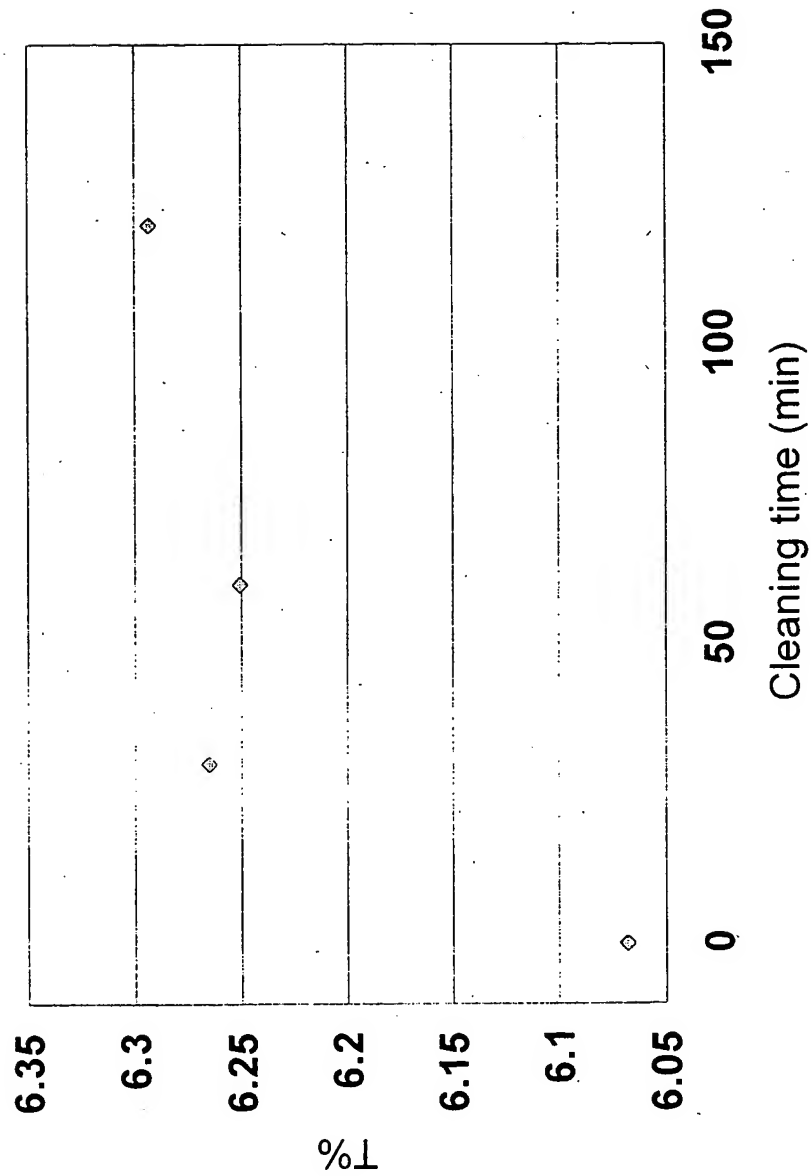


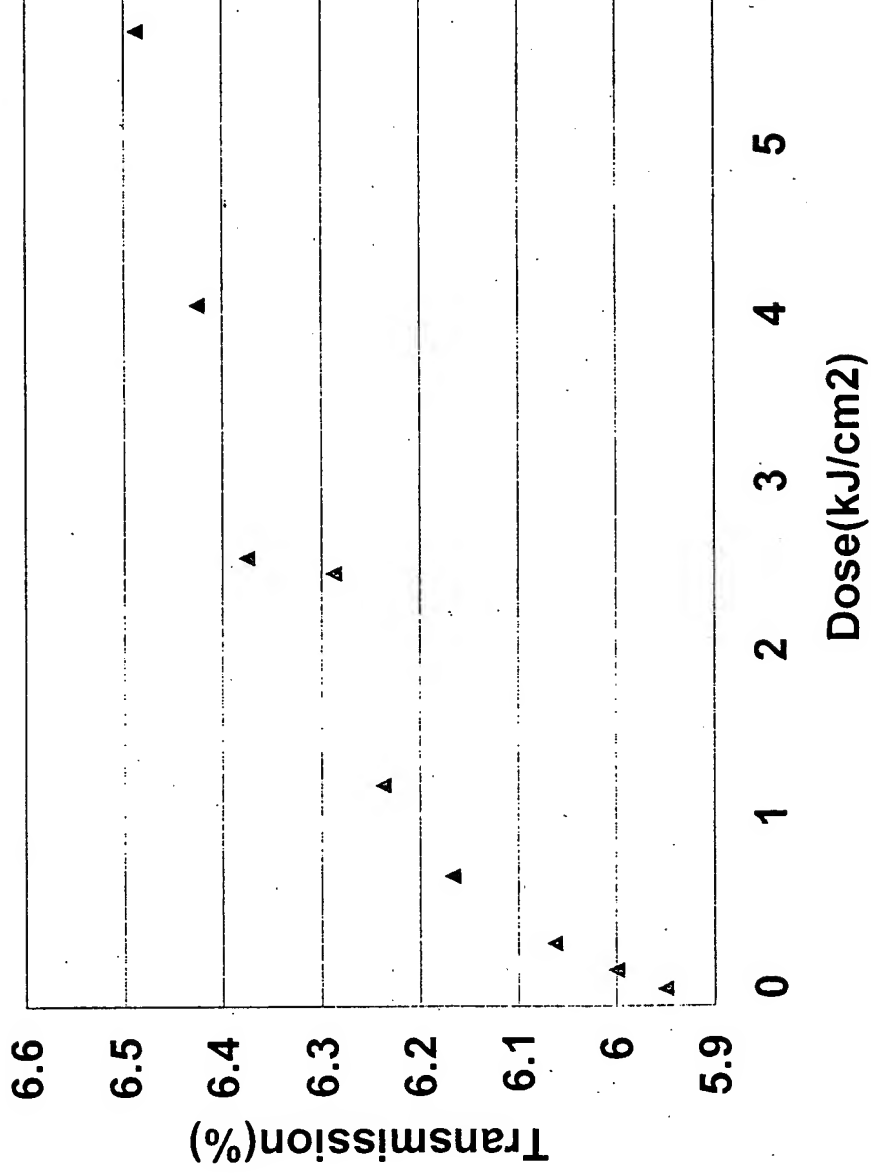
Fig. 6

**SiTiO/Ta****Fig. 7**

Materials	Etch Selectivity	Etch gas
SiTiO/Ti	13	CHF3/CH2F2/Ar
SiTiO/Ta	12	CHF3/CH2F2/Ar
Ti/quartz	25	Cl2
Ta/quartz	4.7	Cl2
SiTiON/quartz	1.7	CF4

Fig. 8



**SiTiO/Ti****Fig. 9**

## SiTiO/Ta bi-layer

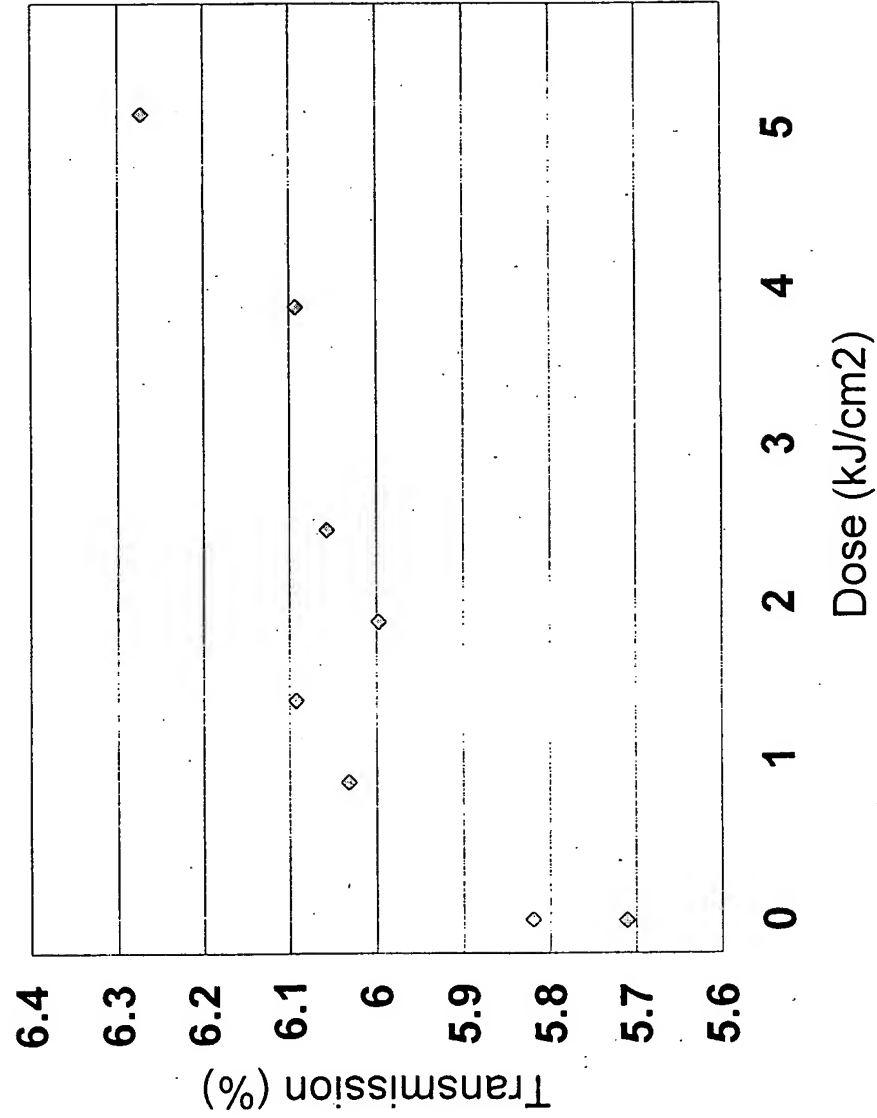
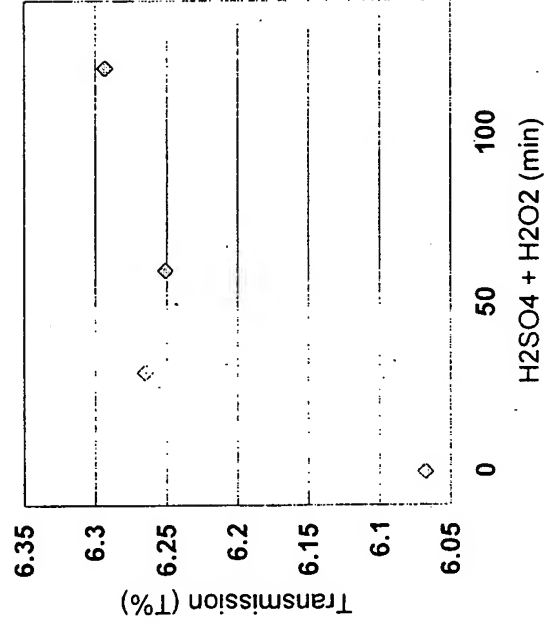


Fig. 10

## IBM 157 nm APSM

- Transmission 6% at 180 degree phase shift
- Tunable up to 12%
- 2-step RIE etch
  - 12:1 (Fluorine based)
  - 5:1 (Chlorine based)

IBM 157 nm APSM - Chemical



IBM 157 nm APSM - Laser

